What is claimed is:

1. An image collation apparatus comprising:

first collation means for obtaining a coincidence ratio between first and second images within a printing element range for each collation unit by collating the first and second images with each other;

minimum coincidence ratio extraction means for obtaining a minimum coincidence ratio from coincidence ratios obtained from said first collation means; and

determination means for determining that the first and second images are identical, if the extracted minimum coincidence ratio is smaller than a predetermined threshold.

2. An apparatus according to claim 1, wherein

said apparatus further comprises first image transformation means for repeatedly executing at least one of translation processing and rotation processing for the first image within a predetermined range for each collation unit and outputting the first image after the image processing, and

said first collation means obtains the coincidence ratio by collating the first image output from said first image transformation means with the second image every time said first image transformation means performs image processing.

3. An apparatus according to claim 1, wherein said apparatus further comprises maximum coincidence ratio extraction means for obtaining a maximum coincidence ratio from coincidence ratios output from said first collation means, and computation means for obtaining a difference between the maximum coincidence ratio output from said maximum coincidence ratio extraction means and the minimum coincidence ratio output from said minimum coincidence ratio extraction means, and said determination means comprises determination means for determining that the first and second images are identical, if the difference output from said computation means is not less than a predetermined threshold.

4. An apparatus according to claim 1, wherein said apparatus further comprises maximum coincidence ratio extraction means for obtaining a maximum coincidence ratio from coincidence ratios output from said first collation means, and computation means for obtaining a quotient by dividing the maximum coincidence ratio output from said maximum coincidence ratio extraction means by the minimum coincidence ratio output from said minimum coincidence ratio extraction means, and

said determination means determines that the first and second images are identical, if the quotient output from said computation means is not less than a predetermined threshold.

5. An apparatus according to claim 1, wherein said apparatus further comprises maximum coincidence ratio extraction means for obtaining a maximum coincidence ratio from coincidence ratios output from said first collation means, and said determination means determines that the first and second images are identical, if the maximum coincidence ratio output from said maximum coincidence ratio extraction means is not less than a first predetermined threshold and the minimum coincidence ratio output from said minimum coincidence ratio extraction means is smaller than a second predetermined threshold (first threshold ≧ second threshold).

6. An apparatus according to claim 2, wherein said apparatus further comprises second image transformation means for repeatedly executing at least one image processing of translation processing and rotation processing for the first image located at a first initial position by a predetermined amount within a predetermined range, and outputting the first image after image processing,

second collation means for obtaining a coincidence ratio by collating the first image output from said second image transformation means with the second image every time said second image transformation means performs image processing, and

storage means for storing a translation amount, rotational angle, or both a translation amount and rotational angle of the first image from the first information position to a current position when the coincidence ratio output from said second collation means becomes maximum, and

said first image transformation means moves the first image to a second initial position set by adding the translation, rotational angle, or translation amount and rotational angle stored in said storage means to the first initial position, and executes at least one of translation processing and rotation processing for the first image.

7. An apparatus according to claim 6, wherein the range predetermined for said first image transformation means is narrower than the range predetermined for said second image transformation means.

8. An apparatus according to claim 6, wherein a collation region in which said second collation means obtains the coincidence ratio is smaller than a

collation region in which said first collation means obtains the coincidence ratio.

9. An apparatus according to claim 6, wherein the translation amount, rotational angle, or translation amount and rotational angle by which said second image transformation means moves the first image for each moving operation are larger than the translation amount, rotational angle, or translation amount and rotational angle by which said first image transformation means moves the first image for each moving operation.

10. An apparatus according to claim 2, wherein

said apparatus further comprises

reference point detection means for detecting reference points of the first and second images located at the first initial position, and

correction amount computation means for obtaining a translation amount, rotational angle, or both translation amount and rotational angle of the first image which is required to make the reference points of the first and second image coincide with each other, and

said first image transformation means moves the first image to a second initial position set by adding the translation amount, rotational angle, or translation amount and rotational angle obtained by said

correction amount computation means to the first initial position, and executes at least one of translation processing and rotation processing for the first image.

11. An apparatus according to claim 6, wherein said apparatus further comprises

reference point detection means for detecting reference points of the first and second images located at the first initial position, and

correction amount computation means for obtaining a translation amount, rotational angle, or both translation amount and rotational angle of the first image which is required to make the reference points of the first and second image coincide with each other, and

said second image transformation means moves the first image to a new first initial position set by adding the translation amount, rotational angle, or translation amount and rotational angle obtained by said correction amount computation means to the first initial position, and executes at least one of translation processing and rotation processing for the first image.

12. An apparatus according to claim 1, wherein said apparatus further comprises region designation means for sequentially designating a plurality of collation regions predetermined as regions

in which the first and second images are collated with each other, and

said first collation means obtains coincidence ratios by sequentially collating the first and second images with each other in the collation regions designated by said region designation means.

13. An apparatus according to claim 12, wherein

said apparatus further comprises computation means for averaging minimum coincidence ratios corresponding to the respective collation regions output from said minimum coincidence ratio extraction means, and

said determination means determines that the first and second images are identical, if the minimum coincidence ratio average output from said computation means is smaller than a predetermined threshold.

14. An apparatus according to claim 2, wherein

said apparatus further comprises region designation means for sequentially designating a plurality of collation regions predetermined as regions in which the first and second images are collated with each other, and

said first collation means sequentially obtains a coincidence ratio by collating the first image output from said image transformation means with the

second image in each collation region designated by said region designation means every time said first image transformation means performs image processing.

15. An apparatus according to claim 14, wherein said apparatus further comprises computation means for averaging minimum coincidence ratios corresponding to the respective collation regions output from said minimum coincidence ratio extraction means, and

said determination means determines that the first and second images are identical, if the minimum coincidence ratio average output from said computation means is smaller than a predetermined threshold.

16. An apparatus according to claim 14, wherein said apparatus further comprises selection means for comparing minimum coincidence ratios corresponding to the respective collation regions which are output from said minimum coincidence ratio extraction means and sequentially outputting only a predetermined number of minimum coincidence ratios in increasing order, and

said computation means averages the minimum coincidence ratios output from said selection means.

17. An apparatus according to claim 1, wherein

said apparatus further comprises image processing means for selecting one of contraction and expansion for one of the first and second images and performing a plurality of different image processes, and

said collation means collates an output from said image processing means with an image having undergone no image processing.

18. An apparatus according to claim 2, wherein

said apparatus further comprises image processing means for selecting one of contraction and expansion for one of the first and second images and performing a plurality of different image processes, and

said collation means collates an output from said image processing means with an image having undergone no image processing.

19. An apparatus according to claim 18, wherein said image processing means performs the plurality of different image processes by repeatedly executing image processing for the selected image for every predetermined amount.

20. An apparatus according to claim 18, wherein said image processing means comprises

thinning means for decreasing a line width of an input image to a value corresponding to about one

pixel, and

expansion means for fattening the image output from said thinning means, and

increases the line width corresponding to about one pixel to a predetermined width, and outputs the image.

21. An apparatus according to claim 18, further comprising storage means for storing an image output from said image processing means and outputting the image to said collation means.

22. An apparatus according to claim 2, wherein

said apparatus further comprises

second image transformation means for repeatedly executing at least one of translation processing (shifting) and rotation processing for the first image located at the first initial position within a predetermined range for every predetermined amount, and outputting a first image after the processing,

second collation means for obtaining a coincidence ratio by comparing/collating the first image output from said second transformation means with the second image every time said second image transformation means performs processing, and

storage means for storing a translation amount, rotational angle, or translation amount and rotational

angle of the first image from the first initial position to a current position when the coincidence ratio output from said second collation means becomes maximum, and

said first image transformation means moves the first image to a second initial position set by adding the translation amount, rotational angle, or translation amount and rotational angle stored in said storage means to the first initial position, and executes at least one of translation processing and rotation processing for the resultant first image.

23. An apparatus according to claim 22, wherein said apparatus further comprises image processing means for selecting one of contraction and expansion for the second image and performing a plurality of different image processes, and

said storage means for storing the second image output from said image processing means, and

said second collation means obtains a coincidence ratio by comparing/collating the first image output from said second image transformation means with the second image output from said storage means every time said second image transformation means performs processing.

24. An apparatus according to claim 22, wherein the range predetermined for said first image

transformation means is narrower than the range predetermined for said second image transformation means.

25. An apparatus according to claim 22, wherein the translation amount, rotational angle, or translation amount and rotational angle by which said second image transformation means moves the first image for each moving operation are larger than the translation amount, rotational angle, or translation amount and rotational angle by which said first image transformation means moves the first image for each moving operation.

26. An apparatus according to claim 22, wherein a collation region in which the coincidence ratio is obtained by said second collation means is smaller than a collation region in which a coincidence ratio is obtained by said first collation means.

27. An apparatus according to claim 3, wherein said apparatus further comprises region designation means for sequentially designating a plurality of collation regions predetermined as regions in which the first and second images are collated with each other, and

said first collation means obtains coincidence ratios by sequentially collating the first image output from said image transformation means with the second

image within a collation region designated by said region designation means every time said first image transformation means performs image processing.

28. An apparatus according to claim 27, wherein said apparatus further comprises image processing means for selecting one of contraction and expansion for one of the first and second images and performing a plurality of different image processes, and said first collation means collates an output from said image processing means with an image having undergone no image processing.

29. An image collation apparatus comprising:

first collation means for obtaining a relationship between first and second images for each collation unit by collating the first and second images with each other;

minimum coincidence ratio extraction means for obtaining a minimum coincidence ratio from coincidence ratios in the relationship obtained from said first collation means;

determination means for determining that the first and second images are identical, if the extracted coincidence ratio is smaller than a predetermined threshold; and

region designation means for sequentially

designating a plurality of collation regions predetermined as regions in which the first and second images are collated with each other,

wherein said first collation means obtains coincidence ratios by sequentially collating the first and second images within the collation regions designated by said region designation means.

30. An apparatus according to claim 29, wherein said apparatus further comprises image processing means for selecting one of contraction and expansion for one of the first and second images and performing a plurality of different image processes, and

said first collation means collates an output from said image processing means with an image having undergone no image processing.

31. An image collation method comprising:

the first collation step of obtaining a coincidence ratio in a predetermined range between first and second images in each collation unit by collating the first and second images with each other;

the minimum coincidence ratio extraction step of obtaining a minimum coincidence ratio from coincidence ratios obtained in the first collation step; and

the determination step of determining that the

first and second images are identical, if the extracted minimum coincidence ratio is smaller than a predetermined threshold.

32. A method according to claim 31, wherein the method further comprises the first image transformation step of repeatedly executing at least one of translation processing and rotation processing for the first image within a predetermined range for each collation unit, and

in the first collation step, a coincidence ratio is obtained by collating the obtained first image after image processing with the second image.

33. A method according to claim 32, wherein the method further comprises

the maximum coincidence ratio extraction step of obtaining a maximum coincidence ratio from coincidence ratios output in the first collation step, and

the computation step of obtaining a difference between the maximum coincidence ratio and the minimum coincidence ratio, and

in the determination step, it is determined that the first and second images are identical, if the difference is not less than a predetermined threshold.

34. A method according to claim 32, wherein the method further comprises the maximum coincidence ratio extraction step of obtaining a maximum coincidence ratio from coincidence ratios obtained in the first collation step, and the computation step of obtaining a quotient by dividing the maximum coincidence ratio by the minimum coincidence ratio, and in the determination step, it is determined that that the first and second images are identical, if the quotient is not less than a predetermined threshold.

35. A method according to claim 32, wherein the method further comprises the maximum coincidence ratio extraction step of obtaining a maximum coincidence ratio from coincidence ratios obtained in the first collation step, and in the determination step, it is determined that the first and second images are identical, if the maximum coincidence ratio is not less than a first predetermined threshold and the minimum coincidence ratio is smaller than a second predetermined threshold (first threshold ≧ second threshold).

36. A method according to claim 32, wherein the method further comprises

the second image transformation step of repeatedly executing at least one image processing of translation processing and rotation processing for the first image located at a first initial position by a predetermined amount within a predetermined range, and obtaining the first image after image processing,

the second collation step of obtaining a coincidence ratio by collating the first image after the image processing with the second image every time image processing is performed for the first image, and

the storage step of storing a translation amount, rotational angle, or both a translation amount and rotational angle of the first image from the first information position to a current position when the coincidence ratio becomes maximum, and

in the first image transformation step, the first image is moved to a second initial position set by adding the translation, rotational angle, or translation amount and rotational angle stored in the storage step to the first initial position, and at least one of translation processing and rotation processing is executed for the first image.

37. A method according to claim 36, wherein the range predetermined in the first image transformation step is narrower than the range predetermined in the second image transformation step.

38. A method according to claim 36, wherein a collation region in which the coincidence ratio is obtained in the second collation step is smaller than a collation region in which the coincidence ratio is obtained in the first collation step.

39. A method according to claim 36, wherein the translation amount, rotational angle, or translation amount and rotational angle by the first image is moved in the second image transformation step for each moving operation are larger than the translation amount, rotational angle, or translation amount and rotational angle by which the first image is moved in the first image transformation step for each moving operation.

40. A method according to claim 32, wherein

the method further comprises

the reference point detection step of detecting reference points of the first and second images located at the first initial position before the respective steps, and

the correction amount computation step of obtaining a translation amount, rotational angle, or both translation amount and rotational angle of the first image which is required to make the reference points of the first and second image coincide with each

other, and

the first image transformation step comprises the step of moving the first image to a second initial position set by adding the translation amount, rotational angle, or translation amount and rotational angle obtained in the correction amount computation step to the first initial position, and executing at least one of translation processing and rotation processing for the first image.

41. A method according to claim 36, wherein

the method further comprises

the reference point detection step of detecting reference points of the first and second images located at the first initial position before the respective steps, and

the correction amount computation step of obtaining a translation amount, rotational angle, or both translation amount and rotational angle of the first image which is required to make the reference points of the first and second image coincide with each other, and

the second image transformation step comprises the step of moving the first image to a new first initial position set by adding the translation amount, rotational angle, or translation amount and rotational angle obtained in the correction computation step to the

first initial position, and executing at least one of translation processing and rotation processing for the first image.

42. A method according to claim 33, wherein the method further comprises the region designation step of sequentially designating a plurality of collation regions predetermined as regions in which the first and second images are collated with each other, and

coincidence ratios are obtained by sequentially collating the first and second images with each other in the collation regions.

43. A method according to claim 42, wherein the method further comprises the image processing step of selecting one of contraction and expansion for one of the first and second images and performing a plurality of different image processes, and

the first and second images are collated with each other by collating the image having undergone the image processing with an image having undergone no image processing.

44. An image collation method comprising:

the first collation step of obtaining a relationship between first and second images for each

collation unit by collating the first and second images with each other;

the minimum coincidence ratio extraction step of obtaining a minimum coincidence ratio from coincidence ratios in the relationship obtained in the first collation step;

the determination step of determining that the first and second images are identical, if the extracted coincidence ratio is smaller than a predetermined threshold; and

the region designation step of sequentially designating a plurality of collation regions predetermined as regions in which the first and second images are collated with each other,

wherein coincidence ratios are obtained by sequentially collating the first and second images within the collation regions.

45. A method according to claim 44, wherein

the method further comprises the image processing step of selecting one of contraction and expansion for one of the first and second images and performing a plurality of different image processes, and

the first and second images are collated with each other by collating the image having undergone the image processing with an image having undergone no image processing.

46. A recording medium storing an image collation program for causing a computer to execute

the first collation step of obtaining a coincidence ratio in a predetermined range between first and second images in each collation unit by collating the first and second images with each other,

the minimum coincidence ratio extraction step of obtaining a minimum coincidence ratio from coincidence ratios obtained in the first collation step, and

the determination step of determining that the first and second images are identical, if the extracted minimum coincidence ratio is smaller than a predetermined threshold.

47. A medium according to claim 46, wherein

the program further comprises the first image transformation step of repeatedly executing at least one of translation processing and rotation processing for the first image within a predetermined range for each collation unit, and

in the first collation step, a coincidence ratio is obtained by collating the obtained first image after image processing with the second image.

48. A medium according to claim 46, wherein

the program further comprises

the maximum coincidence ratio extraction step of obtaining a maximum coincidence ratio from coincidence ratios output in the first collation step, and

the computation step of obtaining a difference between the maximum coincidence ratio and the minimum coincidence ratio, and

in the determination step, it is determined that the first and second images are identical, if the difference is not less than a predetermined threshold.

49. A medium according to claim 46, wherein

the program further comprises

the maximum coincidence ratio extraction step of obtaining a maximum coincidence ratio from coincidence ratios obtained in the first collation step, and

the computation step of obtaining a quotient by dividing the maximum coincidence ratio by the minimum coincidence ratio, and

in the determination step, it is determined that that the first and second images are identical, if the quotient is not less than a predetermined threshold.

50. A medium according to claim 46, wherein

the program further comprises the maximum

coincidence ratio extraction step of obtaining a maximum coincidence ratio from coincidence ratios obtained in the first collation step, and

in the determination step, it is determined that the first and second images are identical, if the maximum coincidence ratio is not less than a first predetermined threshold and the minimum coincidence ratio is smaller than a second predetermined threshold (first threshold ≧ second threshold).

51. A medium according to claim 46, wherein

the program further comprises

the second image transformation step of repeatedly executing at least one image processing of translation processing and rotation processing for the first image located at a first initial position by a predetermined amount within a predetermined range, and obtaining the first image after image processing,

the second collation step of obtaining a coincidence ratio by collating the first image after the image processing with the second image every time image processing is performed for the first image, and

the storage step of storing a translation amount, rotational angle, or both a translation amount and rotational angle of the first image from the first information position to a current position when the coincidence ratio becomes maximum, and

in the first image transformation step, the first image is moved to a second initial position set by adding the translation, rotational angle, or translation amount and rotational angle stored in the storage step to the first initial position, and at least one of translation processing and rotation processing is executed for the first image.

52. A medium according to claim 51, wherein the range predetermined in the first image transformation step is narrower than the range predetermined in the second image transformation step.

53. A medium according to claim 51, wherein a collation region in which the coincidence ratio is obtained in the second collation step is smaller than a collation region in which the coincidence ratio is obtained in the first collation step.

54. A medium according to claim 51, wherein the translation amount, rotational angle, or translation amount and rotational angle by the first image is moved in the second image transformation step for each moving operation are larger than the translation amount, rotational angle, or translation amount and rotational angle by which the first image is moved in the first image transformation step for each moving operation.

55. A medium according to claim 46, wherein the program further comprises the reference point detection step of detecting reference points of the first and second images located at the first initial position before the respective steps, and the correction amount computation step of obtaining a translation amount, rotational angle, or both translation amount and rotational angle of the first image which is required to make the reference points of the first and second image coincide with each other, and the first image transformation step comprises the step of moving the first image to a second initial position set by adding the translation amount, rotational angle, or translation amount and rotational angle obtained in the correction amount computation step to the first initial position, and executing at least one of translation processing and rotation processing for the first image.

56. A medium according to claim 46, wherein the program further comprises the reference point detection step of detecting reference points of the first and second images located at the first initial position before the

respective steps, and

the correction amount computation step of obtaining a translation amount, rotational angle, or both translation amount and rotational angle of the first image which is required to make the reference points of the first and second image coincide with each other, and

the second image transformation step comprises the step of moving the first image to a new first initial position set by adding the translation amount, rotational angle, or translation amount and rotational angle obtained in the correction computation step to the first initial position, and executing at least one of translation processing and rotation processing for the first image.